8.4 Geological Hazards and Resources

This section evaluates the effect of geologic hazards on the project and of the project on geological resources of commercial, recreational, or scientific value. Section 8.4.1 describes the existing environment that could be affected, including regional and local geology and geological hazards. Section 8.4.2 identifies potential environmental effects from project development. Section 8.4.3 discusses potential cumulative effects. Section 8.4.4 discusses possible mitigation measures. Section 8.4.5 presents the LORS applicable to geological hazards and resources. Section 8.4.6 describes the required permits and provides agency contacts. Section 8.4.7 provides the references used to develop this section.

8.4.1 Affected Environment

The WCEP project site is an 11.48-acre parcel located on Bixby Drive in the City of Industry, California, Los Angeles County. The site is relatively flat and is underlain by Quaternary alluvial and older marine sediments.

A site-specific geotechnical investigation was performed in August 2005 at the project site by CHJ, Incorporated. The scope of the study included an evaluation of geotechnical data to develop recommendations for site-specific grading, foundation design, and mitigation of geotechnical constraints. A copy of the geotechnical report is included as Appendix 10G.

8.4.1.1 Regional Geology

The geology of the site vicinity is extremely complex, largely a result of the interaction of the strike-slip tectonics of the San Andreas Fault Zone system and the compressional tectonics of the Peninsular Ranges and Transverse Ranges Province. The site lies with the Peninsular Ranges at the transition with the Transverse Ranges. The Peninsular Ranges are characterized as being somewhat similar to the Sierra Nevada in that both have gentle western slopes and steep eastern slopes. The western sides typically have discrete blocks that slope progressively lower to the west and bordered by major fault zones (Norris and Webb, 1990). The project site lies within the northeastern block of the Los Angeles Basin (Norris and Webb, 1990). The San Andreas Fault Zone lies to the northeast of the project (approximately 25 miles) and is a major tectonic boundary that separates the North American Plate from the Pacific Plate.

Southern California is a highly active seismic region. The numerous active and potentially active faults considered capable of generating earthquakes have caused seismic shaking at the site. Over 30 faults are present within a 62-mile (100-kilometer) radius of the site. The project area is considered to be seismically unstable and is designated under the Universal Building Code as located within Seismic Zone 4. This is the zone with the highest seismic hazard, rated as a 10 percent chance that an earthquake with an active peak acceleration level of 0.4g (4/10 the acceleration of gravity) will occur within the next 50 years.

8.4.1.2 Local Geology

The WCEP site is situated in a valley between the Puente Hills to the south and the San Jose Hills to the north. These two physiographic features are primarily Tertiary in age and consist of folded and faulted marine sedimentary rocks. The WCEP project site lies upon

Holocene-aged alluvial sediments that have been derived from the adjacent hills. The geology within a 2-mile radius of the site is presented on Figure 8.4-1. Groundwater at the site has been detected at a depth of between 23 and 27 feet (CHJ, Inc., 2005).

8.4.1.3 Faulting

Southern California is a region with numerous major fault systems. The project area contains northwest-trending strike-slip faults such as the San Andreas Fault Zone, San Jacinto fault, and Whittier-Elsinore faults. Compressional faults, including the Hollywood, Raymond, and Cucamonga faults, are also present within 20 miles of the site. The site does not lie within or adjacent to an Alquist-Priolo Earthquake Fault Zone (Jennings, 1994). The significant faults in the site vicinity are described below and are shown on Figure 8.4-2.

8.4.1.3.1 San Andreas Fault Zone

The San Andreas Fault Zone lies approximately 28 miles northeast of the site. This fault is the largest active fault in California and extends from the Gulf of California to Cape Mendocino in northern California. The segment of the fault that is closest to the site has exhibited Holocene displacement and is an Alquist-Priolo Zone (Jennings, 1994). Maximum magnitude for this section of the fault is 7.4 (CHJ, Inc., 2005).

8.4.1.3.2 San Jacinto Fault

Approximately 29 miles to the northeast of the site is the northern trace of the San Bernardino segment of the San Jacinto Fault. This fault is also an Alquist-Priolo Zone fault (Jennings, 1994). Maximum magnitude for this fault is 6.7 (CHJ, Inc., 2005).

8.4.1.3.3 Whittier-Elsinore Fault

The northern trace of the Whittier fault is located approximately 3 miles southwest of the site. This fault, coupled with the Elsinore fault, is depicted as an Alquist-Priolo Zone fault and has a maximum magnitude of 6.8. This fault may pose the largest potential seismic hazard to the WCEP, because of its proximity to the site (CHJ, Inc., 2005).

8.4.1.3.4 Newport-Inglewood Fault

The Newport-Inglewood Fault is approximately 19 miles west of the project site. This fault is also an Alquist-Priolo Zone. Its rated maximum magnitude is 7.1 (CHJ, Inc., 2005).

8.4.1.3.5 Hollywood, Raymond, and Sierra Madre Faults

North of the site lie three compressional faults that are also mapped as containing Alquist-Priolo fault zones. These include the Hollywood, Raymond, and Sierra Madre Faults and are less than 20 miles from the site. Maximum magnitudes for these faults are 6.4, 6.7 and 7.2, respectively.

8.4.1.4 Potential Geological Hazards

The following sections discuss the potential geological hazards that might occur in the project area.

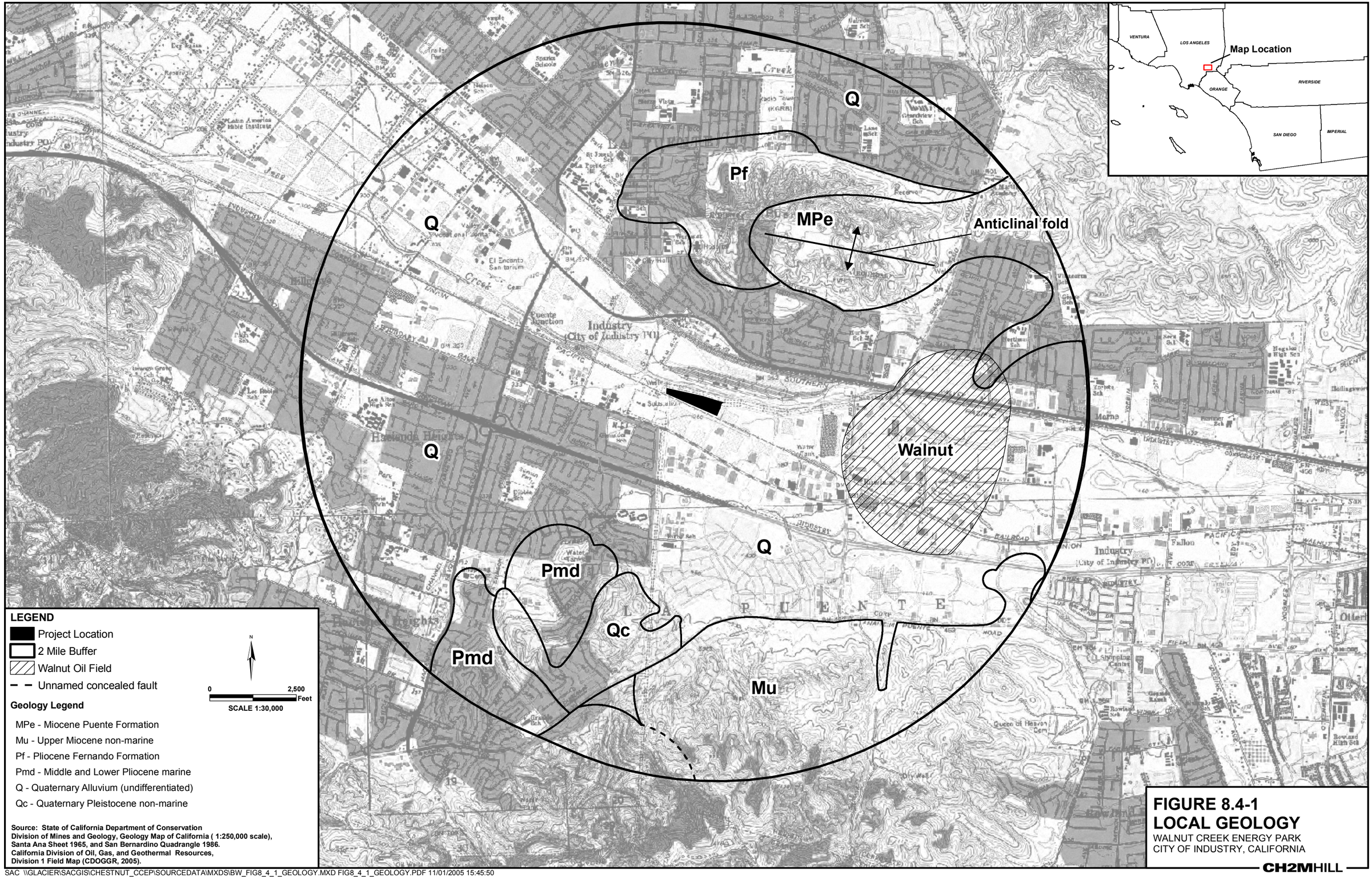

FIGURE 8.4-1
LOCAL GEOLOGY
WALNUT CREEK ENERGY PARK
CITY OF INDUSTRY, CALIFORNIA

CH2MHILL

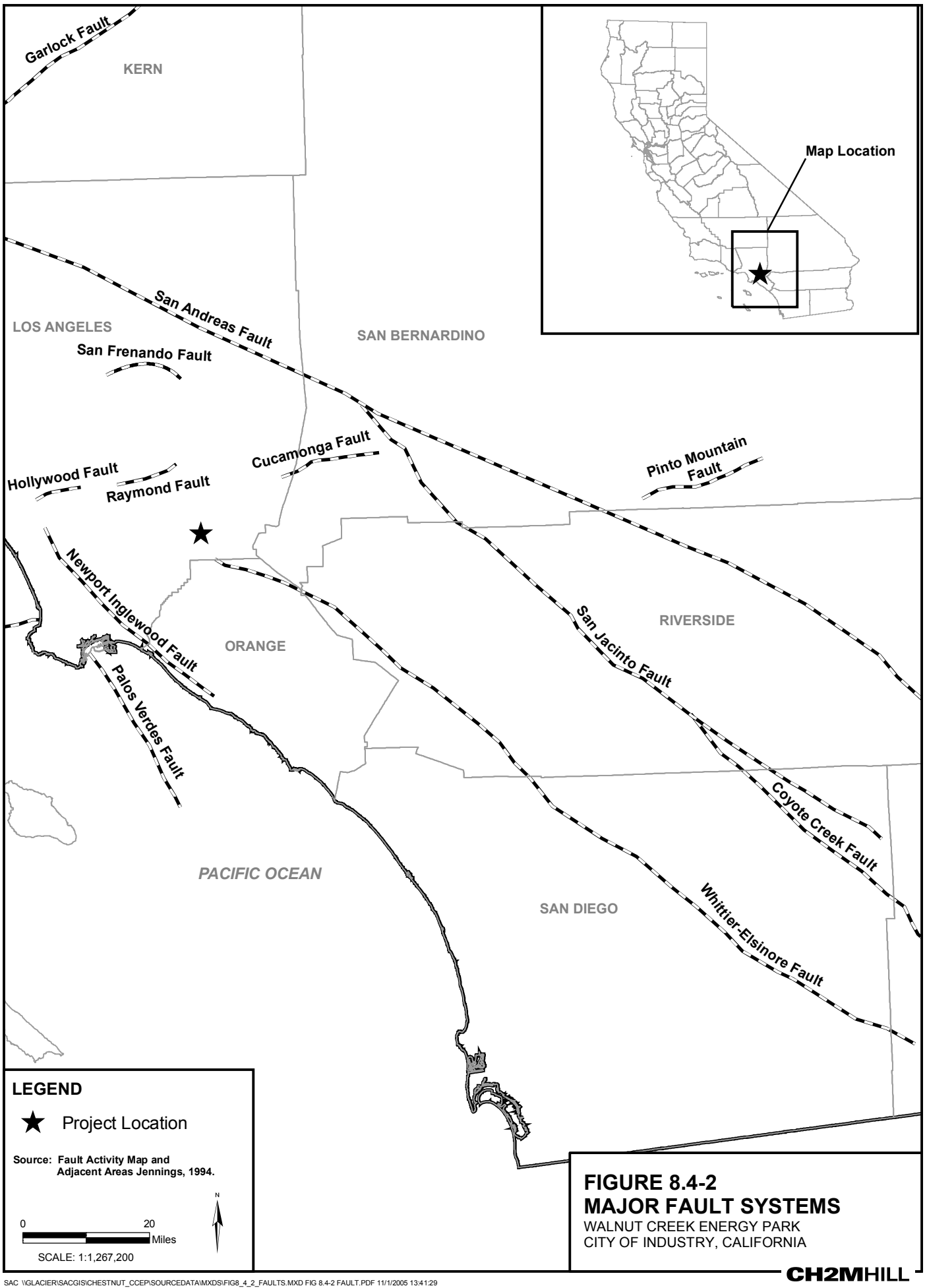

FIGURE 8.4-2
MAJOR FAULT SYSTEMS
WALNUT CREEK ENERGY PARK
CITY OF INDUSTRY, CALIFORNIA

CH2MHILL

8.4.1.4.1 Ground Rupture

Ground rupture is caused when an earthquake ruptures the ground surface. Since no known faults exist at the project site, the likelihood of ground rupture at the WCEP site is low.

8.4.1.4.2 Seismic Shaking

The project area has experienced seismic activity with strong ground motion during past earthquakes, and it is likely that strong earthquakes causing seismic shaking will occur in this area in the future. According to the site-specific geotechnical study conducted for the project site, the estimated peak horizontal ground acceleration with a 10 percent probability of exceedance in 50 years is 0.47g (CHJ, Inc., 2005).

8.4.1.4.3 Liquefaction

During strong earthquakes, loose, saturated, cohesionless soils can experience a temporary loss of shear strength and act as a fluid. This phenomenon is known as liquefaction. Liquefaction is dependent on depth to water, grain size distribution, relative density of the soils, degree of saturation, and intensity and duration of the earthquake. The potential hazard associated with liquefaction is seismically induced settlement. The historic depth to groundwater at the project site is relatively shallow, approximately 23 to 27 feet, and the soil types generally consist of loose to medium dense sandy and gravelly units considered to be susceptible to liquefaction. In addition, this area is within an area identified to have a potential for liquefaction (CHJ, Inc., 2005). Therefore, the likelihood that liquefaction will occur during a strong earthquake is potentially high.

8.4.1.4.4 Mass Wasting

Mass wasting depends on steepness of the slope, underlying geology, surface soil strength, and moisture in the soil. Significant excavating, grading, or fill work during construction might introduce mass wasting hazards at the project site. Because the site is relatively flat and no significant excavation is planned during site construction, the potential for direct impact from mass wasting at the site is considered low to negligible.

8.4.1.4.5 Subsidence

Subsidence can be a natural or man-made phenomenon resulting from tectonic movement, consolidation, fluid removal (oil, gas, or water), or rapid sedimentation or oxidation of organic-rich soil. Organic soils with significant collapse potential were not encountered during the geotechnical investigation of the site (CHJ, Inc., 2005). In addition, oil extraction in the Puente Hills and other nearby areas has typically included water injection techniques that have been shown to slow or halt subsidence and occasionally cause rebounding of previously subsided areas (CHJ, Inc., 2005). The potential for subsidence, as a hazard that could affect the project site, is low.

8.4.1.4.6 Expansive Soils

Expansive soils shrink and swell with wetting and drying. The shrink-swell capacity of expansive soils can result in differential movement beneath foundations. Site-specific borings conducted in the vicinity of the project site have identified clay soils near the surface. Expansion potential testing was conducted and the results showed that a “medium” potential for expansion is present (CHJ, Inc., 2005). Based on this potential, foundation

design should contain a provision to include the potential for expansive soils at the site. Expansive soils are further discussed in Section 8.11, Soils and Agriculture.

8.4.1.5 Geological Resources of Recreational, Commercial, or Scientific Value

There are no known geologic resources that provide a significant scientific or recreational value in the vicinity of the site. Geological resources of commercial value include several oil and gas fields in the project vicinity, according to maps of the State of California Division of Oil, Gas and Geothermal Resources (CDOGGR, 2005). These include the Walnut and Rowland fields, east of the WCEP; North Whittier Heights and Turnbull fields to the west; and the Sansinena and Whittier fields to the south and southwest. The Rowland, North Whittier Heights, and Turnbull fields are abandoned. The Walnut field lies within 0.75 miles of the project site (Figure 8.4-1). The others are more than two miles distant. There are no oil or gas extraction facilities at the project site or near the project site or project linears.

8.4.2 Environmental Consequences

The potential environmental effects from construction and operation of the WCEP on geologic resources and risks to life and property from geologic hazards are presented in the following sections.

8.4.2.1 Significance Criteria

According to Appendix G of the CEQA statues, the project would have a significant environmental impact in terms of geological hazards and resources if it would do the following:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault (Alquist-Priolo fault zone)
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
- Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse
- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state
- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local plan, specific plan, or other land use plan

The potential for land subsidence, either seismically induced or by proposed building load factors and liquefaction hazards is further evaluated in a geotechnical investigation (attached to Appendix 10G).

8.4.2.2 Geological Hazards

There is significant potential for seismic ground shaking to affect the plant site in the event of a large magnitude earthquake occurring on fault segments located near the project. The

project, however, is not located within an Alquist-Priolo Earthquake Fault zone or within the trace of any known active fault. The project would thus not be likely to cause direct human exposure to ground rupture, liquefaction, or strong ground shaking. Seismic hazards and potential adverse foundation conditions will be minimized by conformance with the recommended seismic design criteria of the California Building Code (CBC, 2001) Seismic Zone 4 requirements. The seismic requirements are further defined in Appendix 10B titled, "Structural Engineering Design Criteria."

There is moderate potential for expansive soils (shrink-swell) hazards at the project site. The plant structures and equipment and natural gas compressor station will be designed in accordance with CBC, Seismic Zone 4 requirements. Compliance with the CBC (2001), Seismic Zone 4 requirements will minimize the exposure of people to the risks associated with large seismic events. In addition, the major structures will be designed to withstand the strong ground motion of a design earthquake. A design earthquake is the postulated earthquake that is used for evaluating the earthquake resistance of a particular structure. Because the seismic hazard in the region of the project area is relatively well defined, the design earthquake will be established by the maximum, or characteristic, magnitude earthquake that can potentially occur on those faults as described above.

8.4.2.3 Geological Resources

There are no known geological resources of recreational or scientific value at the project site or in the project vicinity. One oil and gas field is present within one mile of the site (Walnut field). Several other fields are located within 2 to 5 miles. There are no oil and gas extraction facilities at or near the WCEP site, however, and the project would have no effect on oil and gas production or on other geologic resources of commercial value or on the availability of such resources.

8.4.3 Cumulative Impacts

The project facilities will be constructed to the requirements of the CBC Seismic Zone 4. Site-specific geotechnical investigations will be performed before final design and construction. Construction and operation of the project will not cause significant adverse impacts in terms of geological hazards and resources and would also not cause any minor or less than significant impacts that could be considered significant cumulatively with effects of other nearby projects.

8.4.4 Mitigation Measures

Mitigation measures for the project are as follows:

- Perform geotechnical field surveys to locate geologic hazards at the plant site and transmission line route to evaluate their impact on the construction activities and the environment.
- Conduct a geophysical investigation, as required by the Seismic Hazard Mapping Act (1990). The investigation will be conducted prior to facility construction and in accordance with recommended methods outlined in California Division of Mines and Geology's (CDMG) Special Publication 117 titled, "Guidelines for Evaluating and Mitigating Seismic Hazards in California" (1997). In addition, the investigation will

further address potential hazards associated with land settlement and subsidence and expansive/compressive soils.

- Structures will be designed to meet seismic requirements of the 2001 CBC. Moreover, the design of plant structures and equipment will be in accordance with CBC, Seismic Zone 4 requirements to withstand the ground motion of a design earthquake. In addition, special design considerations will be made for constructed facilities, if warranted by the findings from the geotechnical investigation.
- A geotechnical engineer will be assigned to the project to carry out the duties required by the CBC to assess geologic conditions during construction and approve actual mitigation measures used to protect the facility from geologic hazards.
- The soil types present at the project site are somewhat conducive to liquefaction. Pile and foundation design will consider the results of the geotechnical assessment for liquefaction.
- Expansive soils can be mitigated by removing the soil and backfilling with non-expansive soil, instituting chemical stabilization of the soil, or constructing a foundation treatment that resists uplift of the expansive soil. Geotechnical borings at the site have identified soils that are prone to a "medium" degree of expansion potential.

8.4.5 Laws, Ordinances, Regulations, and Standards

The LORS that apply to geologic hazards and resources are summarized in Table 8.4-1.

TABLE 8.4-1
Laws, Ordinances, Regulations, and Standards

Jurisdiction	Authority	Administering Agency	Compliance
Local	Uniform Building Code (UBC), 1997, Appendix Chapter 16, Division 4	City of Industry	Acceptable design criteria for structures with respect to seismic design and load-bearing capacity
State	CBC, Chapters 16, 18, 33, 2001	County of Los Angeles	Acceptable design criteria for structures with respect to seismic design and load-bearing capacity

8.4.6 Permits Required and Permit Schedule

The Uniform Building Code (UBC, 2001) specifies the acceptable design criteria for construction of facilities with respect to seismic design and load- bearing capacity. However, the California Building Standards Code, which subsumes the CBC, incorporates the UBC by reference and contains additional requirements, and is the applicable code to be followed for the project. Compliance of building construction with UBC standards is covered under engineering and construction permits for the project (see Table 8.4-2 for a summary). There are no other permit requirements that specifically address geologic resources and hazards.

TABLE 8.4-2
Permits Required and Permit Schedule

Permit/Required Information	Schedule
Building Permit including Seismic Design Criteria: • Geotechnical/Geologic report • Requires structural, civil, electrical and mechanical plans • Identify geologic hazards and conduct a seismic risk analysis	Submit application 30 days prior to start of construction.
Grading/Drainage/Erosion Control Permit: • Geotechnical/Geological Hazard Evaluation • Engineered Grading Plan • Topographic Plan • Drainage controls • Surface Hydrology Report • Erosion and Dust Control Plan	Submit application 30 days prior to start of construction activities.

8.4.7 Involved Agencies and Agency Contacts

No permits are required for compliance with geological LORS. However, the City of Industry Engineering Department is responsible for enforcing compliance with local building standards, including the CBC (Table 8.4-3).

TABLE 8.4-3
Agency Contact

Issue	Contact/Agency	Title	Telephone
Building Permit	John Ballas City of Industry Engineering Department	City Engineer	(626) 333-2211

8.4.8 References

California Division of Mines and Geology (CDMG). 1997. Special Publication 117: "Guidelines for Evaluating and Mitigating Seismic Hazards in California."

CDOGGR (California Division of Oil, Gas, and Geothermal Resources). 2005. Oil and Gas Field Maps. http://www.consrv.ca.gov/dog.

CHJ Incorporated. 2005. Geotechnical Investigation, 911 Bixby Drive, Walnut Energy Site. City of Industry, CA. Prepared for TIC (The Industrial Company).

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Norris, R. M. and R. W. Webb. 1990. *Geology of California*. Second Edition. John Wiley and Sons. New York.